



2022

Annual Drinking Water System Report

Sandhurst Shores Drinking Water System

DWS# 220003877

Shore Drive
Sandhurst, Ontario

Prepared: January 2023

Executive Summary

The Sandhurst Shores Water Treatment Plant is a chemically assisted filtration plant that services approximately 101 homes. Due to residential growth within the service area of the Sandhurst Shores, the drinking water system changed from a small to large municipal residential drinking water system in 2021. The reliability of the large municipal residential drinking water system is enhanced by continuous monitoring instrumentation, process alarms, and critical equipment redundancy.

During 2022, the total volume of treated water provided to the community decreased by 8% when compared to the volume used during 2021. Significant capacity for treated water remains available to the community as the maximum day flow recorded during 2022 represented approximately 30 percent of the plant design capacity. On an average day during 2022, the community used approximately 13 percent of the plant capacity.

Water samples collected throughout the process at varying frequencies were tested for approximately 70 different parameters to evaluate treatment efficiency and to ensure finished water quality. Target parameters range from critical indicators related to potential acute health effects, to non-health related parameters that aid in assessing process efficiency or the aesthetic quality of the drinking water. All samples analyzed during 2022 met the stringent requirements of the Ontario Drinking Water Quality Standards.

The continual provision of safe and reliable municipal water supply requires diligent upkeep and timely replacement of existing equipment, as well as ongoing efforts to improve efficiency and system reliability. Routine preventive maintenance practices were consistently applied throughout 2022. The exfiltration pit and sewage system at the Sandhurst Shores Water Treatment Plant were replaced in 2022.

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Key Words & Terms

m³ /d	cubic metres per day, (1m ³ = 1000 litres)
mg/L	milligrams per litre, (1 part in 1,000,000)
ug/L	micrograms per litre, (1 part in 1,000,000,000)
ACU	apparent colour measurement units (standard unit to quantify colour in water)
NTU	nephelometric turbidity units (standard unit to quantify turbidity in water)
MAC	maximum acceptable concentration
IMAC	interim maximum acceptable concentration
AO	aesthetic objective (non-health related)

Coagulation / Flocculation refers to the water treatment chemical processes that convert small particles of suspended solids into larger, more settleable clumps.

Disinfection refers to the process that inactivates disease-causing organisms in water, usually by the addition of chlorine.

Escherichia Coli (E. Coli) refers to a subgroup of fecal coliform bacteria that reside in the digestive systems of warm-blooded animals. The presence of *E. Coli* in drinking water is a strong indicator of fecal contamination. *E. Coli* is rapidly destroyed by chlorine.

Heterotrophic Plate Count (HPC) is a microbial test method that quantifies levels of heterotrophic bacteria. Most bacteria, including many of those common in drinking water systems, are heterotrophs. Within a distribution system, increases in the density of HPC bacteria are usually the result of bacterial re-growth which is influenced by the quality of the water entering the system, temperature, flow conditions (i.e. stagnation), presence of a disinfectant residual, construction materials, and the availability of nutrients for growth. HPC in drinking water are not considered a direct health threat to the public.

Inorganic refers to all non-carbon based substances. Common inorganic substances in water include metals, minerals, nutrients, and salts.

ODWQS – refers to the Ontario Drinking Water Quality Standards. The ODWQS define the quality standards, objectives, and guidelines to be followed for the protection of public health through the provision of safe and aesthetically acceptable drinking water supply.

Ontario Regulation 170/03 or O.Reg.170/03 - refers to the Drinking Water Systems Regulation as amended.

Ontario Regulation 169/03 or O.Reg.169/03 - refers to the ODWQS Regulation as amended.

Organic refers to a large group of carbon-based chemical compounds including all animal and vegetable matter plus many synthetic compounds such as pesticides and industrial solvents.

Raw Water is defined as surface (lakes, rivers) or ground water (wells) available as a source of drinking water that has not received any treatment.

Sedimentation refers to the water treatment process that involves reducing the velocity of process water to allow gravity settling of suspended material within relatively large (sedimentation) tanks.

Total Coliform Bacteria are a group of commonly occurring, mostly harmless bacteria that live in soil and water as well as the gut of animals. Their presence in a water sample may be indicative of inadequate filtration and/or inadequate disinfection.

Turbidity refers to a physical characteristic of water that causes a cloudy appearance. Turbidity is caused by the presence of suspended matter. The substances that cause turbidity may be a source of disease causing organisms, and can shield potentially pathogenic organisms from disinfection.

Introduction

The 2022 Annual Drinking Water Report for the Sandhurst Shores Drinking Water System summarizes plant operations and treated water quality with reference to the requirements of Ontario Regulation 170/03 (O.Reg.170/03), Ontario Regulation 169/03 (O.Reg.169/03), Municipal Drinking Water Licence 157-102, Drinking Water Works Permit 157-202, and Permit to Take Water 85-P-4008. This report consolidates the reporting requirements specified as “Annual Report” in O.Reg.170/03, Sec.11, and “Summary Report” in O.Reg.170/03, Schedule 22.

- Section 1 of the report provides a description of the water treatment process.
- Section 2 provides a summary of reports to the Ministry under Subsection 18(1) of the Safe Drinking Water Act (notices of adverse water quality) and Schedule 16, Section 16-4 of O. Reg. 170/03 (notice of inadequate disinfection), as well as any corrective actions taken under Schedule 18.
- Section 3 summarizes the analytical data generated from “in house” analysis as well as contracted analyses conducted at an accredited laboratory in accordance with O.Reg.170/03. Raw and treated water flow rates are also discussed in Section 3. Chemicals used in the treatment process are discussed in both Sections 1 and 3 and are summarized in the tables appearing at the end of this report.
- Maintenance and upgrades carried out during 2022 are summarized in Section 4.

Copies of the Annual Drinking Water Report are available to the public, free of charge, from the Town of Greater Napanee Administration office located at 99A Advance Ave in Napanee. Reports are also available on-line at: <http://www.greaternapanee.com>

Additional information on drinking water standards in Ontario is available from the Ontario Ministry of the Environment, Conservation and Parks (<http://www.ontario.ca>).

1 Description of the Treatment Process

Raw Water Supply

Raw water enters the treatment plant through a 250 mm diameter intake pipe which extends approximately 250 m into Lake Ontario and is submerged to a depth of about 12 m. Screens at the plant inlet prevent any large debris from passing into the treatment process. After screening, raw water flows into a tank referred to as a low lift well from where it is pumped to the treatment process. The low lift pumps are controlled by the volume of treated water stored at the plant. As community use lowers the level of the treated water storage tanks, the low lift pumps are activated to replenish the used volume.

Package Plant Treatment Unit

The Sandhurst Shores treatment process combines coagulation, flocculation, sedimentation, and filtration in one large, partitioned steel tank (Figure 1). This integrated process design, which is common in smaller communities, is referred to as a package plant. Within the package plant, raw water first enters a vertical cylinder known as a draft tube. The draft tube contains a turbine that creates a rapid mixing zone where coagulation is induced by the addition of alum and polymer. As the coagulating chemicals mix with the water, flocculation (gathering together) of suspended particles occurs. As flow progresses downstream from the draft tube, velocity decreases within the flocculation zone where baffles gently mix the flocculated solids causing them to collide and join together to form larger clumps prior to entering the settling compartment.

The settling compartment contains a series of inclined hollow 50mm plastic tubes. The inclined tubes are designed to maximize the rate at which flocculated solids settle to the bottom of the tank. The accumulated settled solids are periodically drained from the bottom of the settling compartment to a waste holding tank. The relatively clear water at the top of the settling compartment flows into the dual media (sand and anthracite) filters. The filters remove particulate matter that may remain in suspension following the settling compartment. The filters require regular cleaning which is accomplished by a process referred to as backwashing. Backwashing temporarily reverses flow through the filter and discharges the wash water to a waste holding tank.

Clearwell Storage and Distribution

Treated water is stored within two reservoirs, commonly referred to as the clearwell, with a total capacity of 227 m³. The reservoirs are located below the package plant. Water from the clearwell is pumped to the distribution system using one of three high lift pumps (1 duty and 2 standbys). Constant distribution system pressure is maintained by a variable speed pump controller and two large pressure tanks.

Waste Residuals Treatment

Waste residuals generated through the treatment process, which includes settling compartment solids and filter backwash water, are discharged from the package plant to a waste holding tank. The thickened, settled material at the bottom of the waste holding tank is withdrawn and hauled to the Napanee Water Pollution Control Plant for further treatment. The relatively clear top treated portion of the waste tank volume is pumped to an exfiltration pit located west of the treatment plant building. The exfiltration pit contains a large volume of granular material that allows the treated water to gradually seep into the surrounding soil.

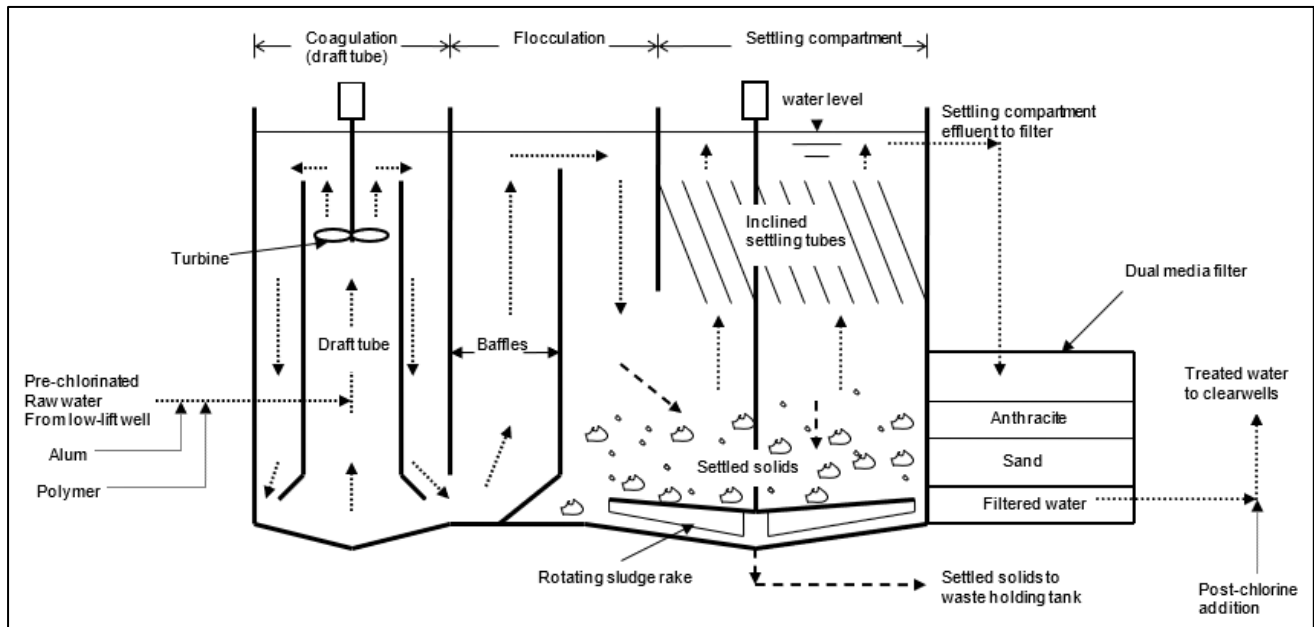


Figure 1: Sandhurst Shores Package Treatment Process Schematic

Disinfection and Zebra Mussel Control

The Sandhurst Shores water supply is dosed with chlorine at two points; one for pre-chlorination / Zebra Mussel control upstream from the package treatment process, and the other for post-chlorination immediately following the package treatment process.

Pre-chlorination is applied at the opening of the Lake Ontario intake pipe. Although marginally useful for initial disinfection, the primary role of pre-chlorination is to control nuisance biological growth and Zebra Mussel infestation within the raw water intake pipe.

Disinfection of treated water (post-chlorination) occurs as the filtered water enters the clearwell. Post-chlorination is a critical and final disinfection step prior to distributing the water to the community. Post-chlorination dosing is adjusted to optimize the inactivation of potentially harmful bacteria, and to ensure that a sufficient concentration of chlorine persists throughout the distribution system. Distribution system chlorine residual prevents biological growth at the farthest reaches of the system.

Treatment Chemicals

Three chemicals; sodium hypochlorite, aluminum sulfate (alum), and polymer are used in the Sandhurst Shores water treatment process.

Sodium hypochlorite contains approximately 12 percent chlorine and is added to the system to control biological growth and ultimately to inactivate pathogens that may be present in the raw water. The sodium hypochlorite solution meets the requirements of the Canadian General Standards Board and American Water Works Association (AWWA) B-300-10 for use in drinking water.

Aluminum sulfate, also known as liquid alum, is used as the primary coagulant in the treatment process. The liquid alum meets AWWA Standard B-403-16 and is approved by the National Sanitation Foundation (NSF), for use in drinking water to a maximum dosage of 150 mg/L.

The anionic polymer used in the water treatment process acts as a flocculant aid. It is supplied in powder form which is mixed with water at the plant and added to the process as a solution. The polymer is approved by NSF for use in drinking water treatment processes to

a maximum dose of 1 mg/L.

Origins and Types of Contaminants

As water travels over the surface of the land or through the ground, it dissolves naturally occurring minerals and can pick up substances resulting from human activity or the presence of animals.

The types of contaminants that may be present in source water include:

- Microbiological contaminants that may come from septic systems, livestock, sewage treatment plants, and wildlife. Microbiological quality is a critical component of drinking water quality because of its ability to cause acute illness in consumers.
- Inorganic contaminants, such as salts and metals, can be naturally occurring or may result from urban storm water runoff, industrial or domestic wastewater discharges, oil and gas production, mining, or farming.
- Organic contaminants can be naturally occurring, but most of the compounds of concern are man-made. Pesticides and herbicides are included in this group and may originate from a variety of sources such as agriculture, storm water runoff, and septic systems.

Multiple Barriers to Microbiological Pathogens

Potentially pathogenic organisms are removed from the raw water source by the following processes:

- pre-chlorination
- flocculation / sedimentation
- filtration
- post-chlorination
- distribution system chlorine residual

Laboratory Testing

Ontario Regulation 170/03 and the Municipal Drinking Water License issued for the plant dictate the sampling and monitoring requirements for the Sandhurst Shores Drinking Water System. Water quality is tested routinely throughout the treatment process and at the

extremities of the distribution system. Testing for any parameters listed as Schedules 1, 2, and 3 of Ontario Regulation 169/03 are conducted at a certified contract laboratory as required by legislation.

Alarms and Staffing

The Sandhurst Shores Water Treatment Plant is typically visited by a licensed operator 7 days per week to perform equipment and process inspections, maintenance, routine lab testing, data collection and review. When the plant is unattended, process irregularities or building security breaches are detected by the plant alarm system and relayed to an on-call operator who is available 24 hours per day, 7 days per week.

2 Reporting of Adverse Water and Other Deficiencies

All samples collected and tested in accordance with O.Reg.170/03 met the requirements of the Ontario Drinking Water Quality Standards. Disinfection of treated water was maintained consistently as prescribed in the MECP publication, *Procedure for Disinfecting Drinking Water in Ontario*. No corrective actions, as detailed in O.Reg.170/03, Schedule 18, were required.

On July 23rd, 2022 an adverse observation was reported to the MECP (AWQI # 159256). During a power outage all the high lift pumps faulted as of a result of the multiple switchovers between the power grid and generator. Samples collected at the time met all the required drinking water standards. To correct this issue from reoccurring delays were added to the plants programming.

Water quality data and disinfectant residuals are provided in summary tables throughout Section 3 of this report.

3 Flow Measurement and Analytical Testing

Raw and Treated Water Flow

Raw water is pumped from Lake Ontario in accordance with the terms and conditions stated in a Permit to Take Water (PTTW) issued by the Ministry of the Environment, Conservation

and Parks. The PTTW allows a maximum withdrawal from the lake of 600 cubic meters per day (m^3/d) and was not exceeded at any time during 2022.

The Sandhurst Shores Water Treatment Plant is licenced to discharge a maximum flow of $372 \text{ m}^3/\text{d}$ into the distribution system. During 2022 the average flow into the distribution system was $48 \text{ m}^3/\text{d}$ while the maximum day flow was $111 \text{ m}^3/\text{d}$. The maximum day flow represents approximately 30 percent of the plant capacity. The total volume of treated water provided to the Sandhurst Shores community during 2022 was decreased by just over 8% when compared to 2021. Table 1 provides a summary of raw and treated water flows.

Table 1: Summary of raw and treated water flow for 2022

Month	Raw Water (m^3/day)				Total Raw Water Flow (m^3)	Treated Water (m^3/day)				Total Treated Water Flow (m^3)
	Min.	Max.	Max. Inst.	Avg.		Min.	Max.	Max. Inst.	Avg.	
January	23	81	198	47	1475	21	75	215	42	1358
February	33	63	300	45	1267	33	53	237	41	1154
March	34	61	218	44	1326	31	62	234	40	1221
April	36	62	198	45	1351	33	53	400	40	1213
May	38	96	332	55	1715	36	94	258	51	1585
June	39	84	288	59	1745	38	81	262	55	1634
July	48	116	240	71	2200	42	111	299	66	2057
August	31	107	359	69	2158	40	109	415	65	2029
September	31	66	188	50	1494	37	62	239	46	1369
October	31	66	198	49	1537	36	64	385	46	1420
November	39	60	229	48	1444	35	57	245	42	1277
December	41	77	205	55	1734	38	69	251	47	1480
Annual	23	116	359	53	19446	21	111	415	48	17797
		600	Permit to Take Water				372	Drinking Water License		

The chart below (Figure 2) shows monthly average day flows for 2021 and 2022, as well as monthly maximum day flows for 2022. The trends clearly depict the moderate increase in water consumption during the warmer months.

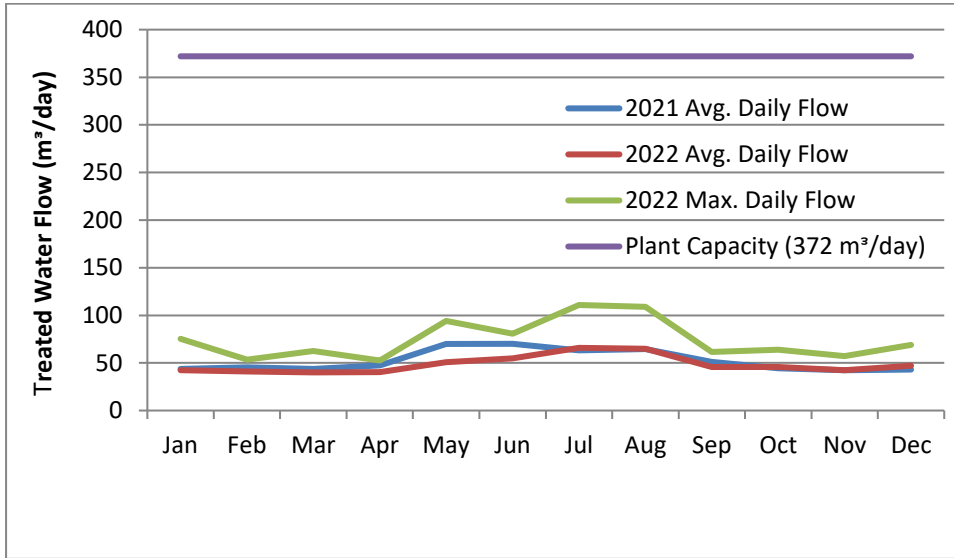


Figure 2: Monthly treated water flow trends for 2021 and 2022.

Flow meter accuracy is verified annually by a qualified instrumentation technician.

Temperature, Colour, Alkalinity, and pH

Temperature, colour, alkalinity, and pH are monitored in raw and treated water throughout each week. Measurements recorded during 2022 are summarized in Table 2.

The data shows that the Sandhurst Shores Water Treatment Plant treats a raw water supply which varies significantly in temperature over the course of the year. Raw water temperature recorded daily ranged from 2.9°C to 23.3°C while treated water temperature ranged from 6°C to 23.1°C. Coagulants do not act as quickly in colder water and therefore higher dosages may be required during winter months.

Colour develops in raw water sources primarily from the decay of naturally occurring aquatic plants. The resulting colloidal and dissolved organic compounds react with coagulant chemicals and can increase dosage requirements. Colour removal can be enhanced by oxidation which occurs during pre-chlorination. In 2022, raw water colour ranged from 0 ACU to a maximum of 58ACU. Effective removal was achieved through the treatment process as the maximum colour result on a treated water sample was 4 ACU.

Coagulants are most effective within specific ranges of pH. For example, alum performs best between pH 5.8 and pH 8.5. It is important to note that alum is an acidic solution which tends to lower the alkalinity and pH of process water. The raw and treated water average pH

values measured during 2022 were 8.1 and 7.4 respectively.

Closely related to pH, alkalinity is a measurement of the acid buffering capacity of water.

(The higher the alkalinity, the more acid that can be added before a change in pH occurs.)

Several substances naturally present in raw water are measured as alkalinity, the majority of which are carbonate compounds. Coagulants, when added to water, combine with the alkalinity to produce insoluble metal hydroxides that play an important role in flocculation. Alum, as mentioned above, is acidic and therefore decreases alkalinity. If too much natural alkalinity is consumed by the alum, there may be insufficient alkalinity for optimal floc formation. Therefore, if a noticeable drop in pH (and alkalinity) is occurring, it may be necessary to lower the coagulant dosage to conserve alkalinity or alter the process by adding alkalinity to the incoming raw water.

During 2022, raw and treated water alkalinities were consistently within the range recommended in the ODWS, Objectives and Guidelines, averaging 89 mg/L and 80 mg/L as CaCO₃, respectively.

Table 2: Summary of temperature, pH, alkalinity and colour in raw and treated water for 2022

Month	Raw Water				Treated Water			
	Average Temperature (°C)	Average pH	Average Alkalinity (mg CaCO ₃ /L)	Average Colour (ACU)	Average Temperature (°C)	Average pH	Average Alkalinity (mg CaCO ₃ /L)	Average Colour (ACU)
January	6.9	7.6	82	10	9.2	7.4	77	0
February	4.4	8.1	100	6	6.9	7.3	86	0
March	3.8	8.1	91	8	7.2	7.3	84	0
April	8.7	7.6	83	10	8.5	7.4	82	0
May	11.7	8.4	90	22	10.4	7.5	76	2
June	14.1	8.4	86	2	13.2	7.5	75	0
July	19.3	8.6	83	10	17.8	7.6	78	0
August	22.6	8.7	100	7	21.5	7.6	89	0
September	21.6	8.2	86	10	21.7	7.4	75	1
October	17.3	7.8	83	6	18.1	7.3	73	0
November	15.9	7.8	89	6	16.6	7.3	81	0
December	12.1	7.6	96	3	12.8	7.3	83	0
Annual Average	13.2	8.1	89	8	13.7	7.4	80	0
Total Range	3.8 - 22.6	7.6 - 8.7	83 - 100	3 - 22	6.9 - 21.7	7.3-7.6	73 - 89	0 - 2
Objective					<15	6.5 - 8.5	30 - 500	5

Turbidity

Effective operation of the treatment processes is verified by continuous monitoring of filter effluent turbidity. In the event of a significant upward trend in filtered water turbidity, an alarm is triggered to notify staff of a process abnormality. If turbidity continues to rise above the alarm limit, a second limit (typically set to half of the compliance limit) will trigger an interlock switch that automatically shuts down the treatment process until the cause is investigated and corrected. The regulation requires that filtered water turbidity must not exceed 1 NTU and that each month at least 95 percent of values are less than or equal to 0.3 NTU.

Table 3 is a summary of raw, filtered, and treated water turbidity measured during 2022. The summary is based on continuous measurement of filtered water and from measurements of raw and treated samples taken at least twice weekly using a portable bench top turbidity meter. The turbidity analyzers are routinely maintained and calibrated by Staff.

During 2022 the treatment process consistently complied with the regulatory limit for turbidity, averaging 0.025 NTU.

Table 3: Summary of turbidity in raw, filtered and treated water for 2022

Month	Raw Water Turbidity (NTU)			Filtered Water Turbidity (NTU)			Treated Water Turbidity (NTU)		
	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.
January	0.20	1.03	0.43	0.014	0.032	0.020	0.01	0.19	0.12
February	0.18	0.33	0.24	0.013	0.089	0.018	0.06	0.13	0.09
March	0.20	0.48	0.32	0.014	0.159	0.026	0.07	0.13	0.09
April	0.28	1.07	0.58	0.020	0.114	0.035	0.12	0.28	0.18
May	0.33	0.46	0.40	0.016	0.089	0.021	0.09	0.15	0.11
June	0.23	0.82	0.54	0.018	0.042	0.025	0.08	0.18	0.12
July	0.29	0.43	0.38	0.015	0.053	0.026	0.05	0.12	0.08
August	0.07	1.57	0.83	0.016	0.142	0.033	0.06	0.23	0.13
September	0.54	1.36	0.94	0.024	0.203	0.034	0.11	0.23	0.16
October	0.00	0.00	0.00	0.025	0.042	0.000	0.10	0.22	0.19
November	0.21	0.88	0.48	0.023	0.058	0.034	0.06	0.17	0.11
December	0.24	0.81	0.44	0.018	0.059	0.034	0.06	0.18	0.11
# samples	103			*			103		
Annual	0.07	1.57	0.46	0.013	0.203	0.025	0.01	0.28	0.12

ODWS MAC				1.0				
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Raw and treated water turbidity is measured throughout each week to monitor raw water quality trends and to ensure that treated water meets the ODWQS aesthetic objective. Raw water values reflected relatively good source water clarity ranging from 0.07 NTU to 1.57 NTU. Treated water turbidity was consistently below the aesthetic objective of 5 NTU, averaging 0.12 NTU.

Disinfection and Bacteriological Testing

Tables 4, 5 and 6 summarize raw, treated, and distribution system disinfectant residuals as well as bacteriological testing results. Chlorine residuals are continuously monitored in pre-chlorinated raw water entering the plant, in treated water leaving the plant, and at one location in the distribution system. Sufficient chlorine must be added to the treated water to satisfy disinfectant contact time requirements (CT), and to maintain a free residual of at least 0.05 mg/L at all locations in the distribution system. The operational guideline (non-health related) maximum concentration for chlorine at any point in the distribution system is 4 mg/L measured as free chlorine, and 3 mg/L measured as combined chlorine.

During 2022, treated water free chlorine residual measured at the treatment plant averaged 1.46 mg/L while the free residual in the distribution system averaged 1.57 mg/L. Disinfection CT, as defined by the Ministry of the Environment, Conservation and Parks publication *Procedure for Disinfection of Drinking Water in Ontario*, was monitored daily, and was consistently achieved.

Table 4: Summary of treated water disinfection and bacteriological results from 2022

Month	Treated Water								
	Free Cl ₂ Residual			Total Cl ₂ Residual			Total Coliforms (org./100mL)	E.Coli (org./100mL)	HPC Range (org./100mL)
	Min. (mg/L)	Max. (mg/L)	Avg. (mg/L)	Min. (mg/L)	Max. (mg/L)	Avg. (mg/L)			
January	1.36	2.00	1.73	1.58	2.18	1.89	0	0	<10 - 10
February	1.38	2.11	1.81	1.72	2.44	2.05	0	0	<10 - 10
March	1.13	1.97	1.67	1.73	2.36	2.03	0	0	<10 - 10
April	1.21	1.79	1.54	1.66	2.08	1.87	0	0	<10
May	1.15	2.03	1.69	1.55	2.19	1.92	0	0	<10 - 10

June	1.05	1.84	1.54	1.47	1.99	1.78	0	0	<10 - 10
July	1.21	2.38	1.74	1.72	2.44	1.98	0	0	<10
August	1.06	2.12	1.61	1.55	2.09	1.82	0	0	<10 - 10
September	0.88	2.05	1.59	1.29	2.19	1.80	0	0	<10
October	1.12	1.94	1.58	1.54	2.05	1.74	0	0	<10
November	1.28	1.99	1.74	1.68	1.95	1.84	0	0	<10 - 10
December	1.22	2.01	1.73	1.58	2.13	1.83	0	0	<10 - 10
# of samples	Continuous			364			53	53	53
Annual	1.17	2.02	1.66	1.29	2.44	1.88	0	0	<10 - 10
ODWQS	0.05	4.00		0.05	7.00		<1	<1	<200

** In addition to continuous monitoring, treated water free chlorine residuals are measured daily through bench top analysis.

Note: Bacteriological results are presented as the range observed for each month.

Verifications of continuous chlorine analyzer readings at the plant are conducted daily using portable bench-top instrumentation. Both continuous and portable instrumentation are routinely maintained and calibrated by staff.

Disinfection of the treated drinking water is confirmed by bacteriological testing on samples collected at the treatment plant as well as from various locations in the distribution system. Of the 159 treated drinking water samples tested for bacteriological quality during 2022, all met the bacteriological requirements of the ODWQS.

Table 5: Summary of distribution water disinfection and bacteriological results from 2022

Month	Distribution Water								
	Continuous Free Cl ₂ Residual			Grab Sample Free Cl ₂ Residual			Total Coliforms (org./100mL)	E.Coli (org./100mL)	HPC Range (org./100mL)
	Min. (mg/L)	Max. (mg/L)	Avg. (mg/L)	Min. (mg/L)	Max. (mg/L)	Avg. (mg/L)			
January	1.15	1.87	1.54	1.08	1.60	1.33	0	0	<10
February	1.62	2.02	1.82	1.35	1.92	1.62	0	0	<10 - 10
March	1.58	1.91	1.74	1.01	1.62	1.40	0	0	<10 - 10
April	1.16	2.09	1.30	1.03	1.30	1.13	0	0	<10 - 10
May	1.10	1.74	1.45	1.09	1.65	1.32	0	0	<10 - 20
June	1.09	1.71	1.45	0.81	1.30	1.03	0	0	<10 - 80
July	1.32	2.03	1.61	0.91	1.73	1.38	0	0	<10 - 80
August	1.21	1.50	1.36	1.13	1.40	1.26	0	0	<10 - 30
September	1.04	1.50	1.33	1.06	1.49	1.31	0	0	<10 - 10
October	1.09	1.40	1.28	0.98	1.21	1.10	0	0	<10
November	1.07	1.41	1.28	1.01	1.54	1.22	0	0	<10 - 10
December	1.30	1.57	1.42	1.23	1.58	1.38	0	0	<10 - 20
# of samples	Continuous			106			106	106	106

Annual	1.07	2.09	1.47	0.81	1.92	1.29	0	0	<10 - 80
ODWQS	0.05	4.00		0.05	4.00		<1	<1	

Note: Bacteriological results are presented as the range observed for each month.

Table 6: Summary of raw water disinfection and bacteriological results from 2022

Month	Pre-Chlorine				Raw Water		
	Continuous Total Cl ₂ Residual			Grab Free Cl ₂ Residual	Total Coliforms (org./100mL)	E.Coli (org./100mL)	HPC (org./100mL)
	Min. (mg/L)	Max. (mg/L)	Avg. (mg/L)	Avg. (mg/L)			
January	0.00	5.47	0.43	0.17	0 - 200	0	60 - >2000
February	0.05	5.46	1.23	0.22	0 - OG	0 - OG	<10 - 460
March	0.01	4.28	0.70	0.17	0 - 3	0	<10 - 20
April	0.33	2.51	0.91	0.09	0	0	<10 - 110
May	0.01	3.68	0.35	0.11	0 - 10	0	100 - 320
June	0.03	5.20	0.46	0.14	0	0	<10 - 180
July	0.00	4.84	0.70	0.26	0	0	<10 - 340
August	0.00	7.39	1.27	0.18	0 - 460	0	>2000
September	0.00	2.09	0.02	0.07	0 - 67	0	560 - >2000
October	0.00	0.47	0.01	0.01	43 - 200	0 - 1	270 - >2000
November	0.00	0.78	0.06	0.05	0 - 22	0	460 - >2000
December	0.00	1.19	0.03	0.05	4 - 37	0	330 - 610
# of samples	Continuous			364	52	52	52
Annual	0.00	7.39	0.51	0.13	0 - OG	0 - OG	<10 - OG

*OG indicates that the sample was overgrown with Heterotrophic Bacteria, no data.

Process Chemical Addition

Table 7 provides a summary of process chemicals used at the plant during 2022.

The average alum dosage observed during 2022 was 44.6 mg/L, which was comparable to the previous year's average dosage of 46.5 mg/L. The average polymer dosage for 2022 was 0.16 mg/L, in 2021 the average was 0.18 mg/L.

Average pre and post-chlorine dosages were 2.61 mg/L and 4.57 mg/L respectively. The total volume of sodium hypochlorite used during 2022 was 918 L.

Table 7: Summary of process chemical usage and dosages for 2022

Month	Alum			Polymer		Sodium Hypochlorite			
	Monthly Usage (L)	Average Dosage (mg/L)	Treated Water Aluminum Residual (mg/L)	Monthly Usage (L)	Average Dosage (mg/L)	Pre-Cl ₂ Usage (mL)	Pre-Cl ₂ Dosage (mg/L)	Post-Cl ₂ Usage (mL)	Post-Cl ₂ Dosage (mg/L)
January	116.5	48.7	0.004	108	0.17	30000.0	2.77	41100	4.46
February	93.2	46.6	0.015	100	0.18	23750.0	2.66	30600	3.80
March	88.3	41.8	0.006	81	0.14	23200.0	2.43	38200	4.49
April	95.6	44.3	0.008	100	0.17	24700.0	2.56	47400	5.59
May	125.0	45.9	0.007	130	0.17	32300.0	2.64	44500	4.11
June	123.8	44.5	0.010	110	0.14	33900.0	2.71	39400	3.50
July	148.3	42.6	0.012	152	0.16	40950.0	2.60	55950	4.03
August	143.4	42.1	0.035	150	0.15	38400.0	2.44	64600	4.82
September	107.9	45.3	0.049	112	0.17	29250.0	2.74	56500	5.91
October	111.4	45.7	0.027	117	0.18	29650.0	2.72	48000	4.85
November	101.8	44.2	0.017	108	0.17	28000.0	2.71	42800	4.81
December	117.7	43.5	0.011	119	0.16	29200.0	2.39	45700	4.51
Annual Avg.	114.4	44.6	0.017	116	0.16	30275	2.61	46229	4.57
Annual Total	1372.7			1387		363300		554750	

Chemical Testing

Analyses of over 70 additional organic and inorganic chemical parameters in the treated water are conducted at various frequencies. The majority of those substances, listed as Schedules 23 and 24 in Ontario Regulation 170/03 must be tested at least annually. Testing for nitrite, nitrate, trihalomethane, and haloacetic acid compounds is required quarterly, while sodium and fluoride must be tested once every 5 years.

The results of those analyses are summarized in Tables 8, 9, 10, 11 and 12. Concentrations of the majority of the substances were lower than the analytical method detection limits (either non-existent or in trace levels too low to measure), while the remaining substances measured below the ODWQS limits.

Table 8: Results of samples collected and analyzed to meet quarterly testing requirements under Schedule 15 of O.Reg. 170/03

Parameter	Units	ODWQS Limit	Date of Sample Collection				Annual Average
			11-Jan-22	05-Apr-22	05-Jul-22	04-Oct-22	
Nitrate	mg/L	10	0.3	0.4	0.2	0.2	

Nitrite	mg/L	1	0.1	0.1	0.1	0.2	
Chloroform	µg/L	-	42	63	49	44	
Bromodichloromethane	µg/L	-	11	10	11	14	
Dibromochloromethane	µg/L	-	3	2	2	5	
Bromoform	µg/L	-	5	5	5	5	
Total THMs	µg/L	100	55	73	63	62	63

Table 9: Results of samples collected and analyzed to meet quarterly testing requirements under Schedule 13 of O.Reg. 170/03

Parameter	Units	ODWQS Limit	Sample Collected				Annual Average
			11-Jan-22	05-Apr-22	05-Jul-22	04-Oct-22	
Haloacetic Acid	µg/L	80	47	48.7	35.1	31.4	40.6
Chloroacetic Acid	µg/L	-	4.7	4.7	4.7	4.7	
Bromoacetic Acid	µg/L	-	2.9	2.9	2.9	2.9	
Dichloroacetic Acid	µg/L	-	22.8	23.8	18.2	16.9	
Dibromoacetic Acid	µg/L	-	2.0	2.0	2.0	2.0	
Trichloroacetic Acid	µg/L	-	24.2	24.9	17	14.5	

Table 10: Results of samples collected on July 07, 2020 to meet testing requirements for Fluoride and Sodium in O. Reg. 170/03

Parameter	ODWQS Limit (mg/L)	Concentration (mg/L)
Fluoride	1.5	<0.1
Sodium	20*	18

*aesthetic objective is 200 mg/L, but the local Medical Officer of Health must be notified when the sodium concentration exceeds 20 mg/L.

Table 11: Results of samples collected on January 11, 2022 to meet testing requirements listed in Sched. 23 of O.Reg. 170/03

Parameter	ODWQS Limit (mg/L)	Concentration (mg/L)
Antimony	0.006	0.0001
Arsenic	0.025	0.0002
Barium	1	0.027
Boron	5	0.015
Cadmium	0.005	<0.000015
Chromium	0.05	<0.002
Mercury	0.001	<0.00002
Selenium	0.01	<0.00
Uranium	0.1	<0.00005

Table 12: Results of samples collected on January 11, 2022, to meet testing requirements listed in Sched. 24 of O.Reg. 170/03

Parameter	ODWS		Concentration (µg/L)
	Limit	Type	
Alachlor	5	IMAC	<0.3
Atrazine + Metabolites	5	MAC	<0.5
Azinphos-methyl	20	MAC	<1

Benzene	5	MAC	<0.5
Benxzo(a)pyrene	0.01	IMAC	<0.006
Bromoxynil	5	IMAC	<0.5
Carbaryl	90	IMAC	<3
Carbofuran	90	MAC	<1
Carbon tetrachloride	5	MAC	<0.2
Chlorpyrifos	90	MAC	<0.5
Diazinon	20	IMAC	<1
Dicamba	120	MAC	<1
1,2-dichlorobenzene	200/ 3	MAC/ AO	<0.5
1,4-dichlorobenzene	5/ 1	MAC/ AO	<0.5
1,2-dichloroethane	5	MAC	<0.5
1,1-dichloroethene	14	MAC	<0.5
Dichloromethane	50	MAC	<5
2,4-dichlorophenol	900/ 0.3	MAC/ AO	<0.2
2,4-dichlorophenoxy acetic acid	100	MAC	<1
Diclofop-methyl	9	MAC	<0.9
Dimethoate	20	IMAC	<1
Diquat	70	MAC	<5
Diuron	150	MAC	<5
Glyphosate***	280	MAC	<25
Malathion	190	MAC	<5
2-Methyl-4-chlorophenoxyacetic acid	0.1	MAC	<1
Metolachlor	50	IMAC	<3
Metribuzin	5	MAC	<3
Monochlorobenzene	80 /30	MAC/ AO	<0.5
Paraquat	10	IMAC	<1
Pentachlorophenol	60/ 30	MAC/ AO	<0.2
Phorate	2	IMAC	<0.3
Picloram	190	IMAC	<5
Polychlorinated Biphenyls	3	IMAC	<0.05
Prometryne	1	IMAC	<0.1
Simazine	10	IMAC	<0.5
Terbufos	1	IMAC	<0.5
Tetrachloroethylene	30	MAC	<0.5
2,3,4,6-Tetrachlorophenol	100/ 1	MAC/ AO	<0.2
Triallate	230	MAC	<10
Trichloroethylene	50	MAC	<0.5
2,4,6-Trichlorophenol	5/ 2	MAC/ AO	<0.2
Trifluralin	45	IMAC	<0.5
Vinyl Chloide	2	MAC	<0.2

Lead Testing

The Sandhurst Shores Drinking Water System qualified for reduced sampling requirements, as measured lead concentrations observed in samples collected from residential plumbing do not pose a risk to public health based on current standards. In 2021, the municipal lead sampling program continued with distribution system testing conducted over two intervals; the first between December 15, 2020 and April 15, 2021 representing cold water conditions, and the second between June 15, 2021 and October 15, 2021 when water temperature was warmer. During each round, staff were required to sample one distribution system location. All of the required samples were collected, and all were below the Ontario Drinking Water Quality Standards limit for lead. The Sandhurst Shores Drinking Water System continues to be exempt from any further residential plumbing sampling unless future distribution testing indicates a change in water chemistry or elevated lead concentrations. There were no requirements to sample for lead in 2022, but the lead sampling program will continue again in 2024.

Table 13: Results of samples collected and analyzed to meet the testing requirements under Schedule 15.1 of O.Reg. 170/03

Sample Location	05-Jan-21			06-Jul-21		
	Lead (mg/L)	Alkalinity (mg/L)	pH	Lead (mg/L)	Alkalinity (mg/L)	pH
Sample Hydrant: Richmond St.	0.00004	73	7.56	0.00005	73	7.46
ODWQS Limit / Objective	0.001*	30 - 500	6.5 - 8.5	0.001*	30 - 500	6.5 - 8.5

*Indicates objective for reduced sampling

4 System Maintenance and Improvements

The following maintenance and system improvement projects were completed during 2022:

- Preventive maintenance was conducted on various plant equipment including automation controls, pumps, flow meters, analytical instrumentation, safety equipment, and the auxiliary power diesel generator. Ongoing preventive maintenance maximizes the life cycle of equipment and minimizes unexpected emergency repairs.
- The Town of Greater Napanee continued to work closely with Quinte Conservation and Cataraqui Region Conservation Authority regarding the approved Source Water

Protection Plans and Education and Outreach programs.

- Distribution system fire hydrants were inspected and lubricated. The hydrant program serves as a preventive maintenance measure that identifies required repairs and ensures reliability for community fire protection.
- The exfiltration pit which is used to dispose of filter backwash water was replaced and upgraded.
- The sewage system that services the plant was replaced with a 9,000L holding tank